

COLD INJURIES: DESCRIPTION, TREATMENT AND PREVENTION



**MSCoE Safety Office
596-0116**



Prepared by:

**U.S. Army Center for Health Promotion and Preventive
Medicine**

(800) 222-9698/ DSN 584-4375/(410) 436-4375

<http://chppm-www.apgea.army.mil>



**With modifications by
The Maneuver Support Center Safety Office (MSO)**

(573) 596-0116/DSN 582-0116

<http://www.wood.army.mil/safety/>



Introduction

Prevention of cold injuries is a responsibility
of both
Command
and
Individuals

***ALL COLD WEATHER INJURIES ARE
PREVENTABLE!!!***

Outline

- **How the Body Regulates Its Temperature**
 - Heat Production
 - Heat Loss
- **Susceptibility Factors**
- **Cold Weather Injuries**
 - Description
 - Treatment
 - Prevention
- **Key Factors: Proper Clothing and Nutrition**
- **Keys for Commanders/Leaders**
- **Conclusion**

Regulation of Body's Temp

- **Body's heat production**
 - **metabolism**
 - **shivering**
 - **exercise**
- **Heat loss**
 - **radiation**
 - **conduction**
 - **convection**
 - **evaporation**
 - **respiration**

Regulation of Body's Temp

- **Body's heat production**
 - **metabolism**
 - **shivering**
 - **exercise**

■ Body's heat production

- ◆ **metabolism**
- ◆ shivering
- ◆ exercise

ILLUSTRATION: Eating high-calorie foods can help keep you warm, to some extent.

METABOLISM

- **Your body produces heat as a by-product of the basic biochemical reactions that keep you alive**
- **Like a constant internal furnace**
- **This is not adequate to satisfy your body's entire heat requirements in winter conditions**

■ Body's heat production

- ◆ **metabolism**

- ◆ shivering

- ◆ exercise

METABOLISM

- Adequate nutrition is essential for adequate metabolism during cold weather
- Cold Soldiers use more calories than warm Soldiers, resulting in increased energy requirements
- During cold weather, Soldiers require about 10 to 40% more calories than when they are not exposed to cold weather

■ Body's heat production

- ◆ metabolism
- ◆ **shivering**
- ◆ exercise

ILLUSTRATION: Shivering can make it difficult to zip a parka, start a camp stove, or perform other activities essential for warming up.

SHIVERING

- Produces heat at a rate up to 5 times greater than our basic metabolic rate
- Limited by the amount of carbohydrates stored in muscles and by the amount of water and oxygen available
- Shivering also hinders our ability to perform the behavioral tasks necessary to reduce heat loss and increase heat production (zipping a parka, starting a stove, etc.)

■ Body's heat production

- ◆ metabolism
- ◆ shivering
- ◆ **exercise**

ILLUSTRATION: If you keep moving, it will help keep you warmer.

EXERCISE

- **Muscles make up 50 percent of our body weight and produce 73 percent of our heat during work**
- **Physical effort can produce tremendous amounts of heat**
- **Limitations: Physical conditioning, strength, stamina and fuel in the form of food and water are necessary to sustain activity**

Regulation of Body's Temp

- Heat loss
 - radiation
 - conduction
 - convection
 - evaporation
 - respiration

■ Heat loss

- ◆ **radiation**
- ◆ conduction
- ◆ convection
- ◆ evaporation
- ◆ respiration

ILLUSTRATION: Clear winter nights tend to be colder than cloudy ones. Cloud cover reflects much of the earth's radiative heat back to the ground. When there are no clouds, the heat escapes.

RADIATION

- The transfer of heat radiation, from a hot object to a cold object.
- This occurs when surrounding objects have lower surface temperatures than the body.
- In the winter, we lose heat to the environment through radiation. Our bodies are warmer than the surrounding air.

■ Heat loss

- ◆ **radiation**
- ◆ conduction
- ◆ convection
- ◆ evaporation
- ◆ respiration

IMPORTANT FACT: The head is an excellent radiator of heat, eliminating from 35 to 50 percent of our total heat production!

RADIATION

- The heat loss from radiation is not dependent upon the movement of air.
- We can lose heat even if the temperature is 70 degrees. In fact, any time the temperature around us is below 98.6 degrees, we can lose body heat.
- Key factors are the amount of body surface area exposed and the temperature of the air and the other things around us.

■ Heat loss

- ◆ **radiation**
- ◆ conduction
- ◆ convection
- ◆ evaporation
- ◆ respiration



RADIATION

- A key is to keep exposed areas of the body covered, especially the head and neck, but, also, hands, feet, and ankles.
- We also can receive radiative heat input from fires, from the sun, or from reflection off snow, water or light-colored rocks



■ Heat loss

- ◆ radiation
- ◆ **conduction**
- ◆ convection
- ◆ evaporation
- ◆ perspiration

ILLUSTRATION: Lying on cold, wet ground versus lying on a rock or beach warmed by the sun

CONDUCTION

- The transfer of heat through direct contact between a hot object and a cold object.
- Heat moves from the warmer object to the cooler object.
- The rate of heat transfer is determined by the temperature difference between the two objects, the amount of surface area exposed to the cold surface, and the effectiveness of the insulation between the body and the cold surface.

■ Heat loss

- ◆ radiation
- ◆ **conduction**
- ◆ convection
- ◆ evaporation
- ◆ perspiration

IMPORTANT FACT: Water conducts heat away from the body 25 times faster than air does.

Stay dry to stay alive!

CONDUCTION

- **Common ways that this loss of heat occurs during military operations are:**
 - **Sleeping on cold ground or snow.**
 - **Contact with water.**
 - **Contact with metal objects.**
 - **Contact with fuels.**

■ Heat loss

- ◆ radiation
- ◆ **conduction**
- ◆ convection
- ◆ evaporation
- ◆ perspiration



CONDUCTION

- **An illustration of how you can lose heat by touching a metal object is firing an M16 in cold weather, without wearing gloves. Your hands will become colder by touching the cold metal.**
- **Conduction heat loss is greater during exposure when exposed skin is wet.**

- Heat loss
 - ◆ radiation
 - ◆ conduction
 - ◆ **convection**
 - ◆ evaporation
 - ◆ perspiration

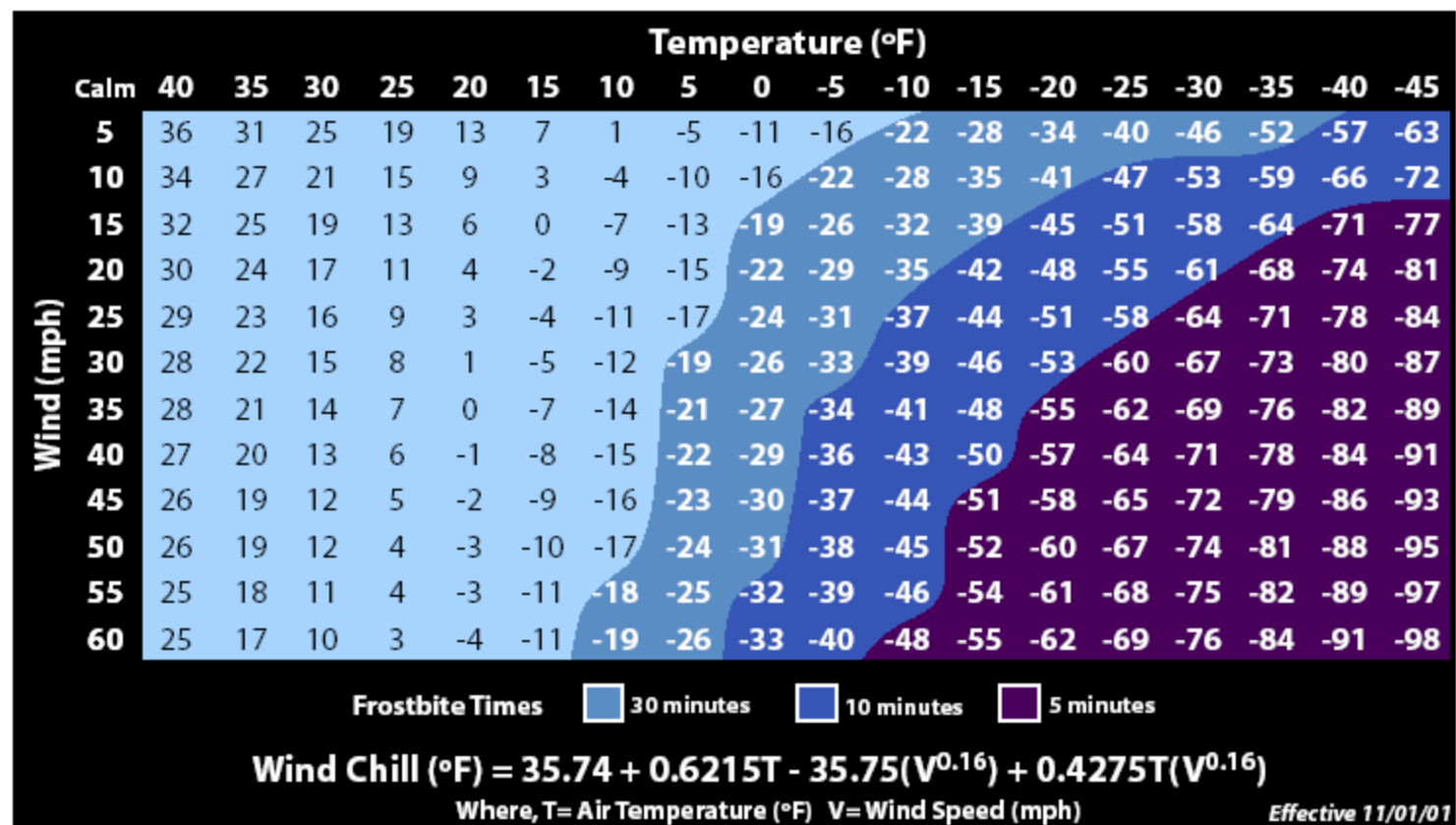
ILLUSTRATION: The greater the air flow, the greater will be the loss of heat

CONVECTION

- Heat lost to moving air or water.
- Besides cooling us directly, moving air strips away the thin layer of air around the body, which has been heated by the body and normally serves as an insulating layer.
- The loss of heat will be much greater if there is wind, unless you are wearing clothing that creates a barrier from the wind.

- Heat loss
 - ◆ radiation
 - ◆ conduction
 - ◆ **convection**
 - ◆ evaporation
 - ◆ perspiration

WIND CHILL



■ Heat loss

- ◆ radiation
- ◆ conduction
- ◆ **convection**
- ◆ evaporation
- ◆ perspiration



CONVECTION

- Even if there is no wind, if there is body movement, such as when running, this will increase the loss of heat.
- The loss of heat can easily be dangerously high when personnel are riding in open vehicles or are exposed to propeller/rotor-generated wind.

■ Heat loss

- ◆ radiation
- ◆ conduction
- ◆ convection
- ◆ **evaporation**
- ◆ perspiration

IMPORTANT: To reduce heat loss through evaporation, avoid hard breathing and sweating. Sweating in cold environments is a bad habit. It wets insulation and cools the body.

EVAPORATION

- Heat lost through the process of vaporization of water.
- When water on the surface of the body evaporates, heat is lost.
- We also lose heat in this way by breathing.
- The most common and usually the most easily explained form of heat loss.
- Accounts for 20 percent of the body's normal total heat loss.

■ Heat loss

- ◆ radiation
- ◆ conduction
- ◆ convection
- ◆ evaporation
- ◆ **respiration**

FACT: In cold weather, we lose 2-9% of our body's heat simply by breathing.

RESPIRATION

- Heat lost from inhaling cold air and exhaling warm air.
- A type of convection.

Susceptibility Factors

- Previous cold weather injury
- Inadequate nutrition
- Alcohol, caffeine, nicotine
- Dehydration
- Overactivity (sweating)
- Underactivity
- Long exposure to the cold
- Sick or injured
- Acclimatization
- Ethnic/geographic origin
- Wind, cold, rain
- Age
- Discipline and morale
- Physical stamina
- Inadequate training
- Poor clothing and equip

Typical Victim of a Cold Weather Injury

- **Male**
- **E-4 or below**
- **Approximately 20 years old**
- **From a warm climate**
- **Less than 18 months time in service**
- **Uses tobacco, alcohol or medications**
- **Neglects proper foot care**

Types of Cold Injuries

DIRECT

- Hypothermia
- Frostbite
- Chilblains
- Immersion/Trench
Foot

INDIRECT

- Dehydration
- Constipation
- Sunburn
- Snow Blindness
- Carbon Monoxide
Poisoning

INJURIES DIRECTLY CAUSED BY COLD WEATHER

- **Hypothermia**
- **Frostbite**
- **Chilblains**
- **Immersion/Trench Foot**

HYPOTHERMIA

A state in which core body temperatures of individuals are below normal because they are losing heat faster than they can produce it

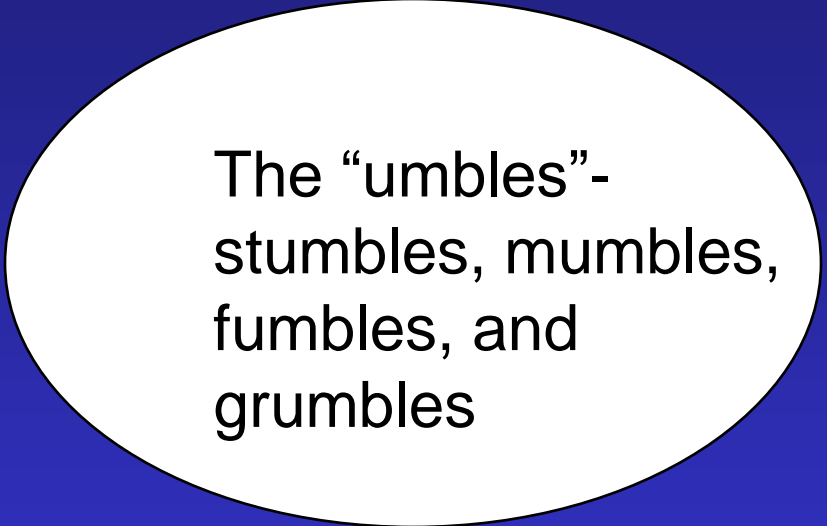
Hypothermia

- MEDICAL EMERGENCY; life threatening condition
- Severe body heat loss-body temp falls below 95°F
- Occurs when:
 - conditions are windy, clothing is wet, and/or the individual is inactive
 - extended water exposure or immersion
 - 1 hour or less when water temp is below 45°F
 - prolonged exposure in slightly cool water (e.g. 60°F)
 - thunderstorms, hail, rain and accompanying winds

Hypothermia

- **Initial Symptoms**

- shivering
- dizzy, drowsy
- withdrawn behavior
- irritability
- confusion
- slowed, slurred speech
- altered vision
- stumbling



The “umbles”-
stumbles, mumbles,
fumbles, and
grumbles

Hypothermia

- **Severe Stages**
 - stops shivering
 - desire to lie down and sleep
 - heartbeat and breathing is faint or undetectable
 - unconsciousness followed by **DEATH**

Hypothermia

- **Treatment**
 - prevent further cold exposure
 - evacuate immediately if severe hypothermia
 - remove wet clothing
 - rewarm with body-to-body contact or in a warmed sleeping bag
 - warm, sweet liquids if conscious
 - Minimize handling of the unconscious victim so as not to induce a heart attack
 - give CPR if needed

Hypothermia

- **Prevention**
 - eat properly and often
 - warm liquids (decaffeinated) and water
 - wear uniform properly (layers worn loosely)
 - keep active
 - stay dry
 - warming tents
 - get plenty of rest
 - buddy watch/observation/NCO checks



BODY TEMP	SYMPTOMS	OBSERVABLE IN OTHERS	FELT BY YOURSELF
(Early Stage) 98.6 \Rightarrow 95.0	Intense and uncontrollable shivering; ability to perform complex tasks impaired	Slowing of pace. Intense shivering. Poor coordination.	Fatigue. Uncontrollable fits of shivering. Immobile, fumbling hands.
(Moderate Stage) 95.0 \Rightarrow 91.4	Violent shivering persists, difficulty in speaking, sluggish thinking, amnesia begins to appear.	Stumbling, lurching gait. Thickness of speech. Poor judgment.	Stumbling. Poor articulation. Feeling of deep cold or numbness.
(Severe Stages) 91.4 \Rightarrow 87.8	Shivering decreases; replaced by muscular rigidity and erratic, jerky movements; thinking not clear but maintains posture.	Irrationality, incoherence. Memory lapses, amnesia. Hallucinations. Loss of contact with environment.	Disorientation. Decrease in shivering. Stiffening of muscles. Exhaustion, inability to get up after a rest.
87.8 \Rightarrow 85.2	Victim becomes irrational, loses contact with environment, drifts into stupor; muscular rigidity continues; pulse and respiration slowed.	Blueness of skin. Decreased heart and respiratory rate. Dilation of pupils. Weak or irregular pulse. Stupor.	Blueness of skin. Slow, irregular, or weak pulse. Drowsiness.
85.2 \Rightarrow 78.8	Unconsciousness; does not respond to spoken word; most reflexes cease to function; heartbeat becomes erratic.	Unconsciousness.	
78.8 \Downarrow	Failure of cardiac and respiratory control centers in brain; cardiac fibrillation; probable edema and hemorrhage in lungs; apparent death.		

FROSTBITE

Injury to tissue caused from exposure to below freezing temperatures. Severe frostbite can result in loss of affected body parts such as fingers, toes, hands, or feet.

Frostbite



Frostbite



Frostbite



Frostbite

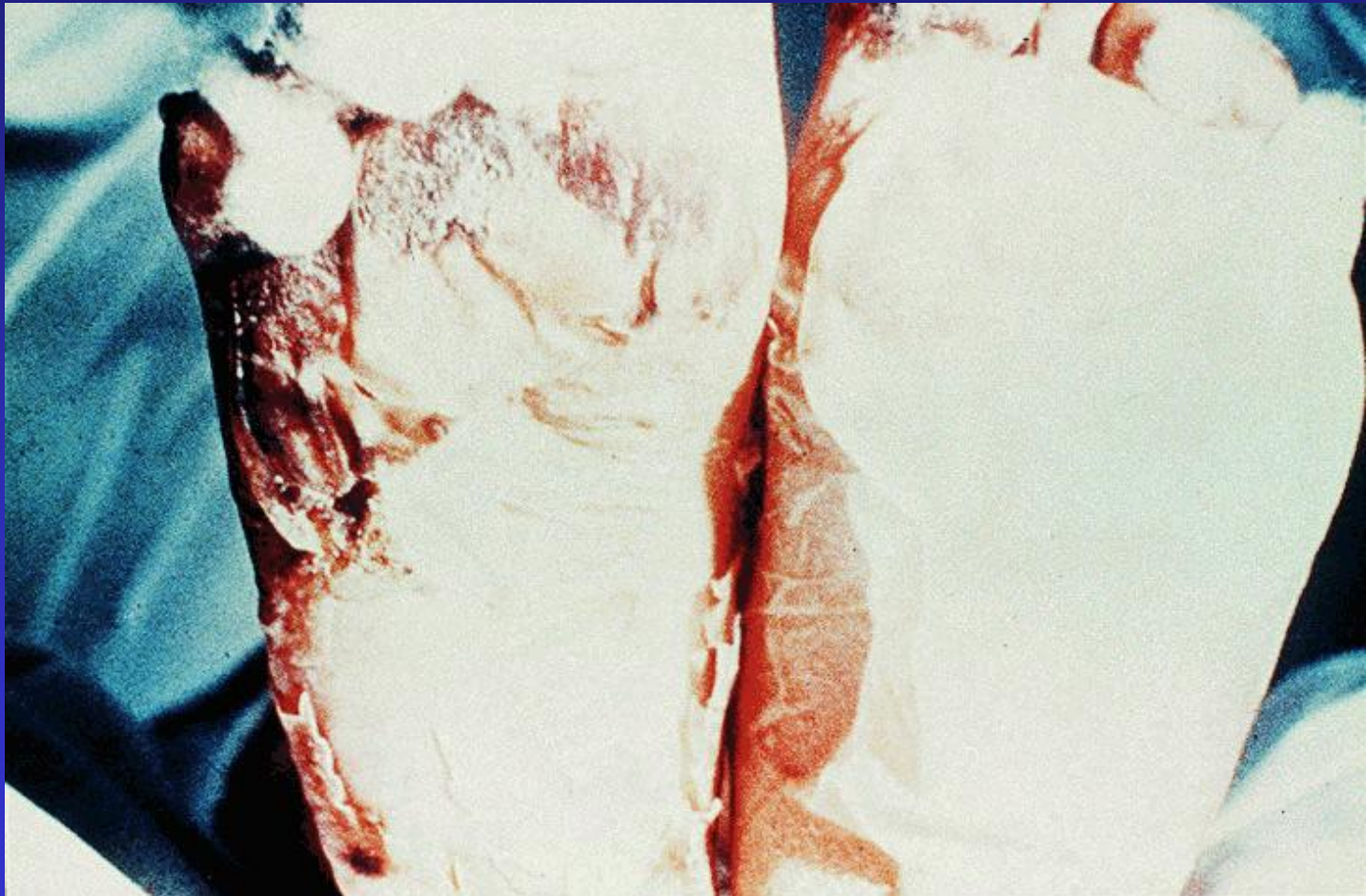


**Toes, one month
after frostbite**



**Eventual outcome – toes
amputated**

Deep Frostbite



Frostbite

- **Air temps below 32°F**
 - skin freezes at 28°F
- **Superficial frostbite (mild)**
 - freezing of skin surface
- **Deep frostbite (severe)**
 - freezing of skin and flesh, may include bone
- **Hands, fingers, feet, toes, ears, chin, nose, groin area**

Frostbite

- Symptoms
 - initially redness in light skin or grayish in dark skin
 - tingling, stinging sensation
 - turns numb, yellowish, waxy or gray color
 - feels cold, stiff, woody
 - blisters may develop

Frostbite

1st Degree (Frost Nip)

- Partial freezing
- Stinging

3rd Degree

- Blue-gray discoloration
- Bleeding blisters

2nd Degree

- Clear Blisters
- Numbness and Burning pain

4th Degree

- Blue
- Deeply aching

Frostbite

- **Treatment**
 - remove from cold and prevent further heat loss
 - remove constricting clothing and jewelry
 - rewarm affected area evenly with body heat until pain returns
 - when skin thaws it hurts!!
 - do not rewarm a frostbite injury if it could refreeze during evacuation or if victim must walk for medical treatment
 - do not massage affected parts or rub with snow
 - evacuate for medical treatment

Frostbite

- **Prevention**
 - wear uniform properly (layers and loosely)
 - keep socks and clothing dry (use poly pro/thermax liner socks and foot powder/ change insoles also)
 - protect yourself from wind
 - keep face and ears covered and dry
 - drink hot fluids and eat often
 - keep active

Frostbite

- **Prevention (cont)**
 - **insulate yourself from the ground (sleeping pad/tree branches etc...)**
 - **“Buddy System”**
 - **warm with body heat**
 - **avoid skin contact with super-cooled metals or fuel**
 - **use approved gloves to handle POL**
 - **seek medical aid for all suspected cases**

Frostbite Dos and DON'Ts

- **DO**

- Periodically check for injury
- Rewarm light frostbite
- Keep injured areas from refreezing
- Get medical attention

Frostbite Dos and DON'Ts

- **DON'T**
 - Rub injury with snow
 - Drink alcoholic beverages
 - Smoke
 - Try to thaw out a deep frostbite injury if you are away from medical care.

CHILBLAINS

Small itchy, red swellings on the skin, which can become increasingly painful, can swell and then dry out leaving cracks in the skin which expose the foot or other body part to the risk of infection

CHILBLAINS



Chilblains

- **Nonfreezing cold injury**
- **Cold, wet conditions (between 32-60°F, high humidity)**
- **Repeated, prolonged exposure of bare skin**
- **Can develop in only a few hours**
- **Ears, nose, cheeks, fingers, and toes**

CAUSE of CHILBLAINS

Chilblains are caused by the skin's abnormal reaction to cold. Damp or draughty conditions, dietary factors and hormonal imbalance can be contributory factors. If the skin is chilled, and is then followed by too rapid warming next to a fire or hot water bottle, chilblains may result.

Chilblains

- **Symptoms:**
 - initially pale and colorless
 - worsens to achy, prickly sensation then numbness
 - red, swollen, hot, itchy, tender skin upon rewarming
 - blistering in severe cases

Chilblains

- **Treatment**
 - prevent further exposure
 - wash, dry gently
 - rewarm (apply body heat)
 - don't massage or rub
 - dry sterile dressing
 - seek medical aid

Chilblains

- **Prevention**
 - keep dry and warm
 - cover exposed skin
 - wear uniform properly
 - use the “Buddy System”

TRENCH FOOT or IMMERSION FOOT

An injury that results from fairly long exposure of the feet to wet conditions at temperatures from approximately 50 to 32 degrees Fahrenheit

Trench/Immersion Foot

- **Potentially crippling, nonfreezing injury (temps from 50°F-32°F)**
- **Prolonged exposure of skin to moisture (12 or more hours, days)**
- **High risk during wet weather, in wet areas, or sweat accumulated in boots or gloves**

Trench/Immersion Foot

Inactive feet in wet socks and boots or tightly laced boots impair circulation and are even more susceptible to injury. Prolonged exposure can cause the feet to swell.

Pressure closes blood vessels, cuts off circulation, and can lead to loss of parts of the feet.

Trench/Immersion Foot

- Symptoms
 - initially appears wet, soggy, white, shriveled
 - sensations of pins and needles, tingling, numbness, and then pain
 - skin discoloration-red, bluish, or black
 - becomes cold, swollen, and waxy appearance
 - may develop blisters, open weeping or bleeding
 - in extreme cases, flesh dies

Trench/Immersion Foot



Trench/Immersion Foot

- **Treatment**
 - prevent further exposure
 - dry carefully
 - rewarm with body heat or exposure to warm air
 - clean and wrap loosely
 - elevate feet to reduce swelling
 - evacuate for medical treatment

Trench/Immersion Foot

– DO NOT

- break blisters,
- apply lotions,
- massage,
- expose to heat,
- or allow to walk on injury

Trench/Immersion Foot

- **Prevention**
 - keep feet clean and dry
 - change socks at least every 8 hours or whenever wet and apply foot powder
 - bring extra boots to field (alternate boots from day to day, to allow boots to dry)
 - no blousing bands
 - report all suspected cases to leadership

INJURIES/ILLNESSES INDIRECTLY RELATED TO COLD WEATHER

- **Dehydration**
- **Constipation**
- **Sunburn**
- **Snow Blindness**
- **Carbon Monoxide Poisoning**

DEHYDRATION

Dehydration is the loss of water and salts essential for normal body function.

Impairs the ability to reason, so the victim may not react properly.

Dehydration

- **A loss of body fluids to the point of slowing or preventing normal body functions**
- **Increases chance of becoming a cold weather casualty, especially hypothermia**
- **Can lead to heat cramps or heat exhaustion**

Dehydration

- Symptoms
 - dark urine
 - headache
 - dizziness, nausea
 - weakness
 - dry mouth, tongue, throat, lips
 - lack of appetite
 - stomach cramps or vomiting....

Dehydration

Symptoms (cont)

- irritability
- decreased amount of urine being produced
- mental sluggishness
- increased or rapid heartbeat
- lethargic
- unconsciousness

Dehydration

- **Treatment**
 - **drink WATER or other warm liquids**
 - **water should be sipped, not gulped**
 - **avoid caffeinated liquids (sodas, coffee, tea)**
 - **do not eat snow**
 - **rest**
 - **get medical treatment**

Dehydration

- **Prevention**

- **drink minimum of 3 canteens of water daily for inactivity and 5-6 quarts for activity**
- **monitor urine color**
- **do not wait until you are thirsty**
- **drink hot liquids for warmth (non-caffeine)**

CONSTIPATION

Change in normal bowel habits (sluggish action) – may be annoying and uncomfortable.

Constipation is harmless but can indicate an underlying disorder.

Fecal impaction can be life-threatening.

Constipation

- **Infrequent or difficult passage of solid human waste**
- **Symptoms**
 - **loss of appetite**
 - **headache**
 - **cramping**
 - **painful defecation**

Constipation

- **Treatment**

- water consumption
- medical treatment may be necessary

- **Prevention**

- drink 4-6 quarts water daily
- available latrine facilities protected from the elements
- eat properly, especially high fiber foods such as fruits, vegetables, whole grain breads

SUNBURN

A painful skin condition which occurs as a result of overexposure to the ultraviolet rays of the sun.

Minor sunburn is a first-degree burn that turns the skin pink or red.

Prolonged sun exposure can cause blistering and a second-degree burn. Sunburn never causes a third-degree burn or scarring.

Repeated sunburns increase the risk of skin cancer in the damaged area.

Sunburn

- **Contributing factors**

- fair skin, light hair
- exposed skin
- reflective qualities of the snow
- high altitudes

- **Symptoms**

- redness of skin, slight swelling (1st deg)
- prolonged exposure (2nd deg)
 - pain and blistering
 - chills, fever, headache

Sunburn

- Treatment

- soothing skin creams in mild cases
- in severe cases, seek medical attention
- aspirin for pain

- Prevention

- cover exposed skin with clothing
- sunscreen, lip balm
- limit exposure of skin to the environment

CARBON MONOXIDE POISONING

**CAUSED WHEN INHALATION OF HIGH
LEVELS OF CARBON MONOXIDE
INHIBITS THE BLOOD'S CAPACITY TO
CARRY OXYGEN.**

**LOW LEVELS OF CARBON MONOXIDE
POISONING CAUSE SYMPTOMS SIMILAR
TO THOSE OF A FLU OR COLD.**

HIGH LEVELS CAN BE FATAL.

Carbon Monoxide

Carbon monoxide is a flammable, colorless, odorless, tasteless, toxic gas produced during incomplete combustion of fuel - Natural Gas, Oil, Coal, Wood, Kerosene, etc.

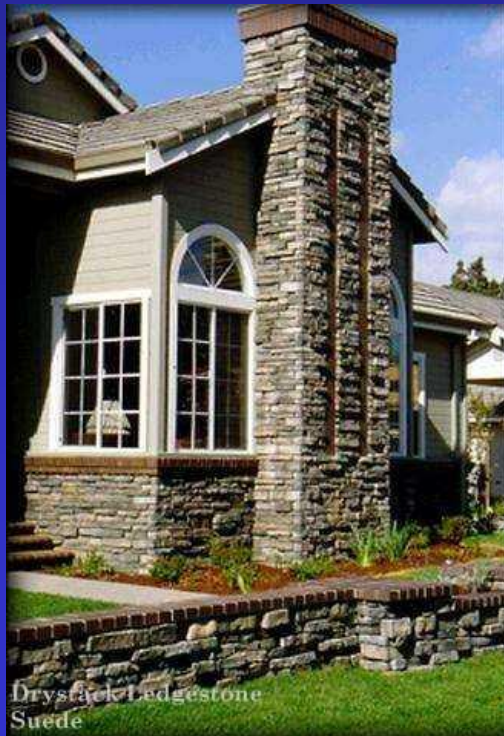
Causes of Carbon Monoxide Poisoning

- Unvented or inadequate ventilation of engines, stoves, heaters



Causes of Carbon Monoxide Poisoning

- Leaking chimneys or furnaces



Causes of Carbon Monoxide Poisoning

- back-drafting from furnaces, gas water heaters, wood stoves, and fireplaces



Causes of Carbon Monoxide Poisoning

- **Automobile exhaust, especially in an enclosed area, such as a garage attached to a house**



Carbon Monoxide Poisoning

- Symptoms
 - headache
 - dizziness
 - weakness
 - excessive yawning
 - ringing in ears
 - confusion
 - nausea
 - bright red lips, eyelids
 - drowsiness
 - unconsciousness
 - possibly death

Carbon Monoxide Poisoning

- **Treatment**
 - move to fresh air immediately
 - seek medical aid promptly
 - provide mouth-to-mouth resuscitation if victim is not breathing

Carbon Monoxide Poisoning

- **Prevention**

- ensure proper ventilation
- don't use unvented heaters or engines
- ensure heaters are regularly serviced
- turn heaters off when not needed (during sleep)
- never sleep in vehicle with engine running
- never wrap poncho around vehicle exhaust to collect heat

SNOW BLINDNESS

**INFLAMMATION AND SENSITIVITY OF
THE EYES CAUSED BY ULTRAVIOLET
RAYS OF THE SUN REFLECTED BY THE
SNOW OR ICE**

- SUNBURNED EYES.

Snow Blindness

Can occur in as little as one hour.

Usually six to twelve hours pass before the eye feels painful and dry and gritty.

It hurts very much to move or open the eye.

Snow Blindness

- Symptoms
 - gritty feeling in eyes
 - redness and tearing
 - eye movement will cause pain
 - headache

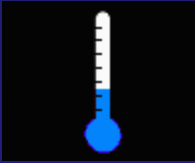
Snow Blindness

- **Treatment**
 - remove from sunlight
 - blindfold both eyes or cover with cool, wet bandages
 - seek medical attention
 - recovery may take 2-3 days

Snow Blindness

- **Prevention**
 - eye protection
 - dark, UV protective glasses
 - field expedient - cut narrow slits in MRE cardboard and tie around head
 - do not wait for discomfort to begin

PREVENTING COLD CASUALTIES

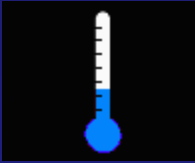


- Prior planning and adequate training
- Cold injuries include:
 - Nonfreezing injuries (trench/immersion foot)
 - Freezing injuries (frostbite)
 - Hypothermia
- Cluster of cold casualties increases risk for more
- 5 steps of cold casualty risk management:
 - Identify Hazards
 - Assess Hazards
 - Develop Controls
 - Implement Controls
 - Supervise and Evaluate



Immersion Foot (mild)

STEP 1: IDENTIFY HAZARDS



➤ To keep warm, remember the acronym **C-O-L-D**

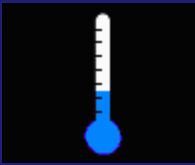
- C** - Cleanliness and Care
- O** - Overheating
- L** - Layers and Looseness
- D** - Dry

➤ The following are cold injury hazards:

- Cold (temperature 40°F or below)
- Wet (rain, snow, ice, humidity or wet clothes)
- Wind (5 mph or greater)
- Lack of adequate shelter/clothes
- Lack of water or provisions



STEP 1: IDENTIFY HAZARDS con't



➤ The following factors combine to place Soldiers at higher risk for cold injury:

- Previous-day cold casualties
- Hunger
- Low activity
- Fatigue/sleep deprivation
- Lack of cold weather experience
- Dehydration or Poor hydration
- Illness or injury/wounds
- Medications
- Prior history of cold injury
- Overly motivated Soldiers
- Tobacco/alcohol within last 24 hrs.



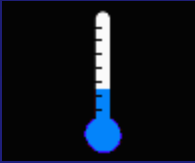
STEP 1: IDENTIFY HAZARDS con't



Prototype Risk Management Worksheet

A. Mission or Task: Train the Army's soldiers			B. Date/Time Group: 1 Oct 03 - 31 Mar 04		C. Date Prepared: 9-Dec-03
D. Prepared By: Command Surgeon's Office, USATRADOC					
E. Task	F. Identify Hazards	G. Assess Hazards	H. Develop Controls	I. Determine Residual Risk	J. Implement Controls ("How To")*
Prevent cold injuries, hypothermia, and carbon monoxide poisoning	Cold (40° F or less)	(M)	Ensure that soldiers have serviceable, properly-fitted clothing, especially footwear, headwear, and handwear; ensure clothing is kept <u>C</u>lean; that soldiers avoid <u>O</u>verheating; that clothing is worn <u>L</u>oosely and in layers; and that clothing is kept <u>D</u>ry. Ensure soldiers use lip balm and sunscreen	(L)	Review local standing operating procedures (SOP) regularly
	Wet environment or wet clothes				Review local risk management worksheets regularly and accept risk at the appropriate level
	Wind (5 mph or more)				Maintain the buddy system
	Lack of adequate shelter/clothing				Post stove watch in tents; ensure sleeping areas are well-ventilated
	Lack of provisions/ water				Do not permit sleeping in or near running vehicles
	Host factors (prior cold injury; skipping meals; low activity; fatigue; sleep loss; lack of experience; dehydration; minor illness; medications; mission-focused)				Enforce regular meal consumption, water and fluid intake, rest periods, physical activity, and change of clothes
	Watch soldiers with minor illnesses and/or taking medications; utilize the buddy system				
K. Determine overall mission/task risk level after controls are implemented (circle one)					
<div> <div>LOW (L)</div> <div>MODERATE (M)</div> <div>HIGH (H)</div> <div>EXTREMELY HIGH (E)</div> </div>					

STEP 2: ASSESS HAZARDS



- Recognize conditions that influence risk of cold injury:

- Temperature
- Wind
- Humidity
- Ground conditions

- Wind Chill Chart

- Movement or lack of it

New Wind Chill Chart

		Wind (mph)												
		Calm	5	10	15	20	25	30	35	40	45	50	55	60
Temperature (°F)	40	36	34	32	30	29	28	28	27	26	26	25	25	
	35	31	27	25	24	23	22	21	20	19	19	18	17	
	30	25	21	19	17	16	15	14	13	12	12	11	10	
	25	19	15	13	11	9	8	7	6	5	4	4	3	
	20	13	9	6	4	3	1	0	-1	-2	-3	-3	-4	
	15	7	3	0	-2	-4	-5	-7	-8	-9	-10	-11	-11	
	10	1	-4	-7	-9	-11	-12	-14	-15	-16	-17	-18	-19	
	5	-5	-10	-13	-15	-17	-19	-21	-22	-23	-24	-25	-26	
	0	-11	-16	-19	-22	-24	-26	-27	-29	-30	-31	-32	-33	
	-5	-16	-22	-26	-29	-31	-33	-34	-36	-37	-38	-39	-40	
	-10	-22	-28	-32	-35	-37	-39	-41	-43	-44	-45	-46	-48	
	-15	-28	-35	-39	-42	-44	-46	-48	-50	-51	-52	-54	-55	
	-20	-34	-41	-45	-48	-51	-53	-55	-57	-58	-60	-61	-62	
	-25	-40	-47	-51	-55	-58	-60	-62	-64	-65	-67	-68	-69	
	-30	-46	-53	-58	-61	-64	-67	-69	-71	-72	-74	-75	-76	

Frostbite occurs in 15 minutes or less

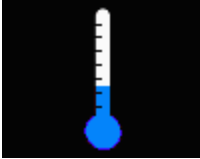
$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$




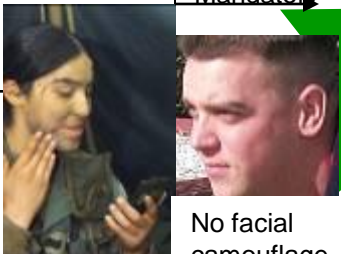



Where, T = Air Temperature (°F)

V = Wind Speed (mph)

STEP 2: ASSESS HAZARDS

Recommended Uniform and Work Modifications

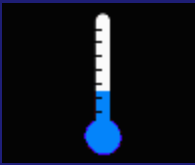


Work Intensity		Little Danger			Increased Danger	Great Danger
		+40	+10	0	-20	-65
High Digging foxhole, running, marching with rucksack, making or breaking bivouac	Increased surveillance by unit leaders				Extended cold weather clothing system or equivalent; cover exposed skin	Postpone non-essential training; essential tasks only with less than 15 min exposure; work groups of no less than 2; cover all exposed skin
Low Walking, marching without rucksack, drill and ceremony		Cover exposed skin			Restrict non-essential training; 30-40 minute work cycles with frequent supervisory surveillance for essential tasks	Cancel outdoor training
Sedentary Sentry duty, eating, resting, sleeping, clerical work		Vapor barrier boots Below 0° F				Postpone non-essential training; 15-20 minute work cycles for essential tasks; work groups of no less than 2 personnel; no exposed skin
						
Polypropylene underwear (worn next to skin), field jacket liner, and field jacket for temperatures +40 to -20						

Polypropylene underwear (worn next to skin), field jacket liner, and field jacket for temperatures +40 to -20

Provide warming facilities

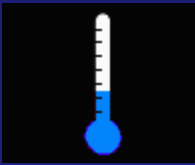
STEP 3: DEVELOP CONTROLS



- **Train all leaders and all Soldiers every year**
- **Properly fitting cold weather clothing and footwear**
- **Insulation (layering); adjustments for activity and environment**
- **Don't allow wear of Gortex during physical activity**
- **Every Soldier wears gloves**
- **Lip balm/ChapStick**
- **Gloves approved for handling POL, when applicable**
- **Integrate controls into SOP**



STEP 4: IMPLEMENT CONTROLS



➤ Battle buddies are the first-line of defense

➤ Leadership controls:

- Uniform checks
- Limit activities in extreme cold
- Covered troop transport
- Warming tents
- Hot food & drink

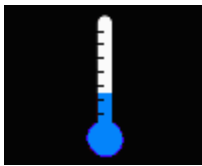
➤ Facility controls:

- Army approved heaters
- Properly train fire guards
- Heating equipment is properly maintained
- Inspect shelters for maximum cold protection and structural safety



Battle of the Bulge, Jan 1945

STEP 4: IMPLEMENT CONTROLS

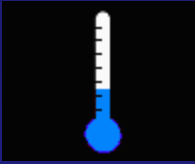


Cold Weather Clothing -- Physical Fitness Uniform

Wind chill	T-shirt and trunks	Add jacket	Add pants, cap, and gloves
More than 60° F:	x		
Between 50°-60°F:	x	x	
Less than 50°F:	x	x	x



OTHER COLD WEATHER LEADER CONTROLS



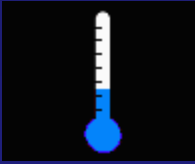
➤ Leaders should **repeatedly** ask the following questions concerning the risk for Cold Injury when planning and executing training in cold weather:

- Do Soldiers have adequate shelter/clothing?
- Have Soldiers eaten warm meals?
- Are Soldiers in contact with bare metal or POL?
- Are Soldiers in contact with wet ground?
- Are Soldiers in wet clothes?
- Can Soldiers move about to keep warm?
- Do Soldiers have dry and warm feet?
- Are battle buddy teams being maintained?



Valley Forge, DEC 1777

STEP 5: SUPERVISE AND EVALUATE



- Leaders take personal responsibility
- Set and enforce the standard
- Monitor implementation of controls
- **SPOT CHECK, SPOT CHECK, SPOT CHECK!** (ears, nose, hands, feet)
- Record, report, and monitor risk:
 - Increase of cold injury casualties
 - Increased complaints/comments about cold
 - Shivering, stomping, jumping-jacks
 - Signs or symptoms of frostbite



Frostbite

Conclusion

- Dress properly
- Drink plenty of fluids
- Eat right
- Keep in shape
- Get plenty of rest
- Minimize periods of inactivity
- Maintain a positive attitude
- Implement Cold Casualty Risk Management

Reference Materials

- **Center for Army Lessons Learned Newsletter No. 97-5 Winning in the Winter**
- **Technical Note No. 92-2 Sustaining Health and Performance in the Cold: Environmental Medicine Guidance for Cold-Weather Operations**
- **Army Field Manual 21-76, dated June 1992, US Army Survival Manual.**
- **TC 21-3 Soldier's Handbook for Individual Operations and Survival in Cold-Weather Areas**
- **FM 31-70 Basic Cold Weather Manual**
- **FM 21-10 Field Hygiene and Sanitation**
- **FM 21-11 First Aid for Soldiers**
- **TB MED 508 Prevention and Management of Cold Weather Injuries**
- **FD Pam 40-5 Win in the Heat and Cold: Climatic Injury Prevention Guide**

QUESTIONS?

